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An Essential Ingredient

Water for agriculture, the subject of last month's column, is practically synonymous with agriculture's survival in the American West. Millions of acres of prime cropland in the 17 western states blossom with an ingredient essential to all of life—water.

But that water is unevenly distributed. And the opportunity which the frontier West has represented to eight generations of Americans has changed in time and place. This opportunity has disappeared and reappeared with the shifting, sometimes fickle, frequently unpredictable appearance of water. It brings life to the deserts of the Southwest and harvests to the semi-arid plains of Texas and Oklahoma.

The West, historically a symbol of opportunity, still holds the promise of a bright future for American agriculture. The key to that future is in the wise management of its water resources. SEA scientists and researchers, and their colleagues in State Agricultural Experiment Stations, are developing ways to do just that; these are the most promising—

Plants tolerant of poor quality water. The water quantity problem in the West is cyclic; the water quality problem is constant. Increased use of pesticides, over-irrigation and, occasionally, industrial wastes all contribute to contaminating a frequently scarce water supply. Basic research is now underway to develop strains of wheat, millet, and range grasses which are not only tolerant of saline water, for example, but thrive in spite of it.

Plants which do well with little water. Here, plants are bred not to utilize less water per plant (usually an impossibility), but to be more productive with no additional water.

Conservation in irrigated use. Excess irrigation not only wastes water, it hastens the leaching of nitrogen out of the soil, thereby potentially contributing to the degrading of the ground-water below. Irrigation efficiency can be improved by better land forming (leveling and smoothing the land), automated irrigation systems, and the use of surface mulches to curb soil water evaporation.

Fallow land use. SEA scientists are now attempting to determine how to increase the amount of precipitation stored in the soil during the fallow period. A related area—snow management—involves using grass strips, windbarriers, and rough tillage to cause snow to accumulate evenly, and then remain evenly distributed over the land for more effective absorption when it melts.

The use of waste water. Recycling waste water has been successful in several places in the West where sewage effluent treatment combined with good, underground water storage has been an important asset to agriculture.

Ground water management. The artificial recharging of aquifers whose water tables have begun to recede has been extensively used in California, where one-fourth of all the national groundwater withdrawals takes place. Ninety-six percent of earth's freshwater (outside the polar ice caps) is in the ground; greater knowledge of the proper management of groundwater would be a boon to American—and especially western—agriculture.

The findings from these and other research projects will enable scientists to better manage our water resources—an essential ingredient that will insure a viable, prosperous future for American agriculture.—*Robert W. Deimel*

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COVER: Two advances in food production technology, described on pages 10 and 11, show how SEA scientists turn agricultural research into benefits for the food industry and consumers.

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Arlan Benteman is one of 12 Kansas livestock producers using solar power to heat swine farrowing houses. He should recover his initial investment within 7 years (0279W220-22A).

Solar Power on the Farm

USING SOLAR energy on the farm was only an idea in the early 1970's. Today it is an idea whose time has come. Solar power is here, helping to produce meat for the dinner table.

Twelve Kansas livestock producers are using solar power to heat swine farrowing houses. By year's end, the number will be at least 16.

"A producer investing in a solar collector-storage system similar to an experimental unit located here (Kansas State University) can recover his investment in 7 years," claims James P. (Pat) Murphy, Extension agricultural engineer in structures and environment. "Many traditional farm structures are built with the hope that the investment is returned in 10 years."

Murphy is the conduit through which research information collected at the experimental facility, built 4 years ago, is transmitted for actual on-farm use. Under a combination Department of Energy (DOE) and USDA-SEA grant, Murphy spends a third of his time working with farmers interested in solar-heated hog facilities.

Once producers decide to go that

route, they may get their plans and instructions from Murphy. And the specialist throws in some practical advice to help get the project off the table.

The plans basically reflect experimental work done at K-State by professor Charles Spillman, Department of Agricultural Engineering. Animal science professor Robert H. Hines and research assistant Victor Robbins aided Spillman on the project.

Spillman built the experimental 8 by 50 foot solar collector-storage unit on the south wall of the farrowing house at the university's swine research center. Partial funding was provided by the Economic Resource Development Agency (ERDA).

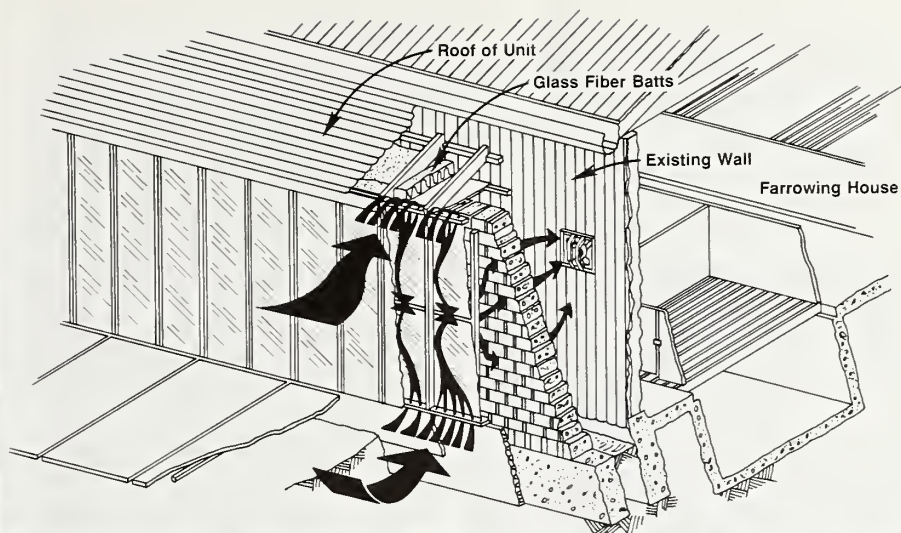
The idea is to use the solar wall to preheat ventilating air in the hog house. In winter, fresh air entering a livestock building must be heated to the temperature in the confined space. In Kansas, where high winds may combine with cold temperatures to send the wind chill index plummeting to several degrees below zero, energy required to obtain that goal can be excessive. Most producers use LP gas or electricity to heat the space.

Solar energy is ideal in this case, Spillman points out, because a system to preheat the ventilating air can use energy of much lower quality, as heat of any kind in winter reduces the amount of conventional energy used.

Another appealing feature of solar power is that producers don't have to build a new structure to take advantage of the sun—a wall can be added to an existing building, as done at K-State.

The main features of the solar wall,





Top left: Alan Johnson, assistant research engineer, keeps a watchful eye on monitoring equipment in the nursery on Dale Keesecker's farm in Washington, Kansas (0279W217-25).

Bottom left: This view of a solar-powered farrowing house shows isolettes in the background—individual quarters for a single brood sow and baby pigs. The isolettes will eventually be phased out, thus saving labor and energy costs (0279W218-4).

Top right: This solar energy collection and storage wall supplies natural heat for Kansas State's farrowing house. Arrows show the path of air as it is heated on its way to the ventilating fan. (PN-4189)

Bottom right: Arlan Benteman (left), pork producer from Clifton, Kansas, and Alan Johnson review the monitoring procedures of the solar installation. The cup anemometer measures wind speed in front of the solar collectors, which gives the researchers an idea of heat loss due to the wind (0279W219-5).

Dale Keesecker's solar collectors were built from concrete blocks and resin reinforced fiber glass panels. All materials needed to build a solar-powered farrowing house are readily available to producers through building contractors, lumberyards, and solar energy vendors (0279W217-34).



Charles Spillman (left) and James P. Murphy discuss possible alternatives for improving the performance of solar units being used by a pork producer (0279W213-26A).

which provide a net collecting area of 380 square feet, are a stack of solid concrete blocks (6 by 8 by 16 inches) painted black with openings from front to back, and a double transparent plastic cover on a frame that allows ventilating air to pass between the covers as it enters the system.

Moving the air through the space between the covers allows the air to pick up some of the heat that would otherwise be lost. The air removes heat from the south side of the blocks first and cools the surface to further reduce heat loss from the storage.

Inside, a centrifugal fan connected to a duct system moves the air to the furnace in the farrowing house.

Spillman says the solar energy collected and used January through March one year was equal to burning 335 gallons of propane; from April 1 through June, savings equaled 170 gallons.

With farrowing house temperatures maintained at 60° to 65° F., Spillman estimates the equivalent of 1 gallon of propane is saved for each square foot of collector for Kansas conditions. Savings would vary depending on location.

The scientist believes the basic concept of the solar energy collector-storage system for preheating ventilating air will become a viable economic alternative as energy becomes less available and more expensive.

"We plan to continue research and hopefully refine the system to make it even more efficient," he said.

As for cost, Murphy said his experience with farmers indicates that a solar wall for preheating ventilating air in a farrowing house can be built for \$7.50 per square foot of collecting space. About \$4 of that amount is labor.

Plans and operating instructions for the collecting system are available from Murphy at Extension Agricultural Engineering, Seaton Hall, Manhattan, KS 66506. The cost is \$3 for each set.—(By Bill Sullins, Kansas State University, Manhattan.)





Breakthrough Discovery in Wheat

A FUNDAMENTAL breakthrough for wheat research is the discovery of *Pythium*—a fungus that rots the seed or destroys the feeder roots of growing plants—as a cause of poor wheat growth under conservation tillage. R. James Cook, a SEA plant pathologist at Pullman, Wash., made the discovery.

Conservation tillage (or no-till) is desperately needed for erosion control in the annually cropped areas of the Pacific Northwest. Growers don't like the practice because it has been unprofitable—yields are often much less than under conventional tillage.

By controlling *Pythium*, Cook has been able to obtain yields under conservation tillage equal to or better than yields obtained under conventional tillage. If further research is successful, his work could eliminate a major obstacle to grower adoption of conservation tillage and enable the terrible erosion in the Northwest to be greatly reduced.

Pythium comes in a multitude of species and lives in soil as thick-walled spores triggered to germinate in response to the least little bit of nutrient, regardless of the nutrient's source. It is one of the few fungi active in cold, wet soil. After germination, *Pythium* spreads rapidly and attacks dead as well as living plant material, causing either pre- or post-emergence damage or stopping plants from getting nutrients out of the soil. Infected plants grow poorly and mature late. Yield, of course, also suffers.

Cook calls *Pythium* "one of the most

widespread and underestimated fungi in agricultural soils." His theory is that rain hitting virgin (no active microorganisms) straw lying on the soil's surface under a conservation tillage program provides the water and humidity microorganisms need to grow. Colonizing the straw and using it as a food base, the *Pythium* then attacks wheat plants.

Once the straw becomes moldy, it is safe from *Pythium* which cannot colonize plant material already colonized by another fungus.

According to Cook, however, *Pythium* is quick enough to grow first and produce in the straw a damaging disease that does not require direct contact to infect a seed.

Using an experimental systemic fungicide that spreads downward as well as upward, Cook has been able to achieve practically 100 percent *Pythium* control. He's been sprinkling or mixing the fungicide into the soil, but there are indications that it could be applied directly to the seed.

More work is needed to establish the rates and best method of fungicide application and more tests are needed to determine which *Pythium* species are causing the problems. Working with Cook on this project are SEA technicians Jerry W. Sittan and Jack T. Waldher, also of Pullman.

Dr. Cook is located at the Northwest Cereal Disease Laboratory, Room 367, Washington State University, Pullman, WA 99164.—(By Lynn C. Yarris, SEA, Oakland, Calif.)

Computers - a Weapon in the War Against Pollution

FARMERS, ranchers and land-use planning agencies may soon have an important computer "tool" that could help in reducing non-point-source pollution from agricultural land.

Non-point-source pollution is sediment, chemical fertilizer, and pesticides coming off the land and ending up in the Nation's lakes, rivers, and streams.

The movement of water, fertilizers, and pesticides through soil and the chemical reactions due to that movement are a highly complex phenomena. Add to that climate, soil types, land slope, farming practices, radiation, rainfall, and other criteria and there exist complexities to boggle the mind.

Those complexities must be understood, in order to assess what is currently happening on the land and predict the effect of different farming practices. Farmers and land-use groups could then select the best management practices for each farm or watershed.

Without the aid of computers, implementing water quality programs would be an almost insurmountable task. Planners would have to monitor each watershed or farm and prescribe corrective measures when pollution is excessive.

That solution may not be necessary, however, since SEA scientists have developed a computer program into which most of the complexities have been programmed.

Fifty SEA scientists, under the direction of Walter G. Knisel, Jr., Tucson, Ariz., have pooled hundreds of scientific staff-years of research and experience into the program.

"All of the knowledge we now possess has gone into the computer program and is being tested on a number of re-

search watersheds in eight land-resource regions," says Knisel, a hydraulic engineer.

A land-resource region contains similar soils, climate and vegetation. There are 20 such regions in this country.

Three main components of the computer programs are:

- Natural component—precipitation as rain or snow, radiation (solar energy or sunlight), and temperature.
- Management component—land use, cultural practices, plant nutrients, and pesticides.
- Physical component—geology, soil type, and topography of the farm or watershed.

With that information, the computer should be able to assess pollution coming from a particular farm field, determine the responses coming from the same field when a change in farming methods is suggested; and evaluate and suggest the best farming system to reduce pollution.

To be practical, any computer model must be simple, physically based, and capable of simulating surface and subsurface water flow, deep percolation (seepage), erosion, sediment movement, and dissolved and adsorbed chemical output from fields under different management or farming practices.

When speaking of the computer program as being "simple", Knisel is quick to point out that it is meant to be simple to use by action agencies. The computer program or mathematical model is complicated.

"For instance, assessing non-point-source pollution from pesticides alone is very complicated, because of the

thousands of different chemical compounds used and thousands of formulations.

"Each compound has a different half-life, persistence in soil, chemical formulation, and mode of transport, and all that information must be available to the computer.

"Herbicides have been classified into 13 different chemical types, and insecticides and miticides into seven. How





the chemical is applied makes a difference in computing pollution. Applied as a spray to bare soil or on a crop canopy alters its movement or degradation. On the canopy, some chemical is either intercepted by the foliage or it falls onto the soil surface. Degradation on the soil will be different from that on the foliage. The frequency and amount of rain and other factors all make a dif-

ference in the portion of chemicals that can, could, or will run off the land in water or with sediment," Knisel says.

Sediment is the nation's number one polluter. It has been estimated that at least 3 billion tons of soil are washed out of fields and pastures each year—enough soil to cover 21,000 80-acre farms to a depth of 1 foot.

Almost all water resources develop-

ments and the suitability of water for many uses are affected by sediment. Fertilizers cause eutrophication or aging of the nation's waters. The over-enrichment promotes algal growth and depletes oxygen necessary for fish survival. Pesticides cause a number of problems.

The reason for SEA's effort is that agriculture has a responsibility to the Federal Water Pollution Control Act of 1972. That Act, amended in 1977 by the Clean Water Act and Resource Conservation Act, has a goal set by Congress "to restore and maintain chemical, physical, and biological integrity to the Nation's waters." The deadline is 1985.

"The computer models under development for evaluating agricultural pollution from farm fields should not be considered as complete nor an end in themselves. They are the first step towards the development of practical computer models useful to persons, such as Soil Conservation Service specialists, in predicting pollution from basin-sized areas. The initial efforts will help identify areas in which future research is needed. Then well-planned data collection programs must be developed to provide for a sound water management program for resource conservation," Knisel says.

"SEA is the only agency in the country, probably the world, with a range of scientific talent large and diverse enough to put such a computer program together," Knisel concludes. Dr. Knisel is stationed at the Southwest Range and Watershed Research Center, 442 East Seventh Street, Tucson, AZ 85705.—(By Paul Dean, SEA, Oakland, Calif.)

Tying Cauliflower

CAULIFLOWER fanciers and growers alike should benefit from the recent development of a cauliflower "tier."

Maturing cauliflower heads are sensitive to direct sunlight. They "burn" easily, become discolored, and take on a strong flavor.

Many growers send crews through the field to gather the leaves over the heads and tie them up with rubber bands. This operation costs about \$100 per acre including the cost of the bands.

Other growers, conscious of the narrow profit margin from the field to the wholesale house, have one or two leaves folded over the head for some protection. Other growers do nothing, taking their chances on sunburn damage.

The prototype tier, developed by Don Lenker, SEA agricultural engineer is a relatively small, tractor-mounted, prototype machine that gathers the leaves over the head and ties them with string. It is capable of tying 3,800 plants per hour at a tractor speed of about three-quarters of a mile per hour. That's one row. A commercial machine would tie at least two rows at a time.

Manually, one person can average about 500 plants per hour.

When the machine is driven through the field, two endless belts sloped downward at about 45 degrees lift the bottom leaves of the plant up to two horizontal belts. Those belts direct the leaves through the machine at the same speed as the tractor. The plants are intercepted by string placed at right angles to the horizontal belts. As the machine moves forward past the cauliflower plant, the string more or less encircles the gathered leaves.

Meantime, at the bottom of the machine a foam-covered, horizontal wheel

is "feeling" the plant at its widest part. As the roller is spread "out" by the matured head and starts back "in," a modified commercial tying mechanism is actuated. It ties a knot, cuts the string and tier returns to its place ready to be triggered for the next knot.

The tier is a stock tier used in many mail rooms and shipping departments and was the item that gave the most trouble, Lenker says.

Since the tier was designed to remain stationary while tying most packages, Lenker had to design a linkage to allow the tier to "travel" with the cauliflower plant. The linkage allows the tier to move with the plant for about 4 inches, do its job, and return for the next cycle.

Since cauliflower heads do not mature at the same time, fields must be selectively harvested a number of times. Tied plants must be easily separated from each other and be capable of being picked by a mechanical harvester previously developed by Lenker.

"The tier," Lenker says, "individually ties approximately 93 percent of the plants. Less than 1 percent are not tied. The rest are two plants tied with one loop, plants tied with 2 loops, or plants tied too loosely."

Estimated cost of the cauliflower tying machine is from \$4,000 to \$5,000, Lenker says.

There are about 30,000 acres of cauliflower grown in California, Arizona, Michigan, New York, Texas, and Oregon. Winter grown cauliflower in California, Arizona, and Texas amounting to about 5,000 acres need not be tied.

Lenker's address is U.S. Agricultural Research Station, P.O. Box 5098, Salinas, CA 93901.—(By Paul Dean, SEA, Oakland, Calif.)





Zig-zag Planting Profits

A RELATIVELY simple modification on vegetable planters allows a “non-conventional” method of growing cauliflower that could mean extra profits for farmers. This new zig-zag pattern, which fills in the spaces between the rows and takes advantage of unused sunlight, results in a 33 percent yield increase over the single-row conventional system.

SEA agricultural engineer Dale E. Wilkins, Salinas, Calif., modified a two-row planter so that it plants three seeds about an inch apart on one side of a 20-inch bed, and alternately plants three more on the other side of the bed continuously down the row. After the plants are established and thinned to one plant per site, the pattern allows a minimum distance of 14 inches from a plant to its nearest neighbor. Maximum distance is about 17 inches.

Wilkins mounted two unit planters where normally there is one and ran them from a common shaft. It was then only a matter of timing for the seed drop to get the zig-zag pattern. Conventionally, one row of cauliflower is planted straight down the row on the 20-inch bed and plants are thinned to about 12 inches apart.

Comparison of the two-row and the single-row systems showed the two-row system produced—after thinning—more than 17,400 plants per acre. Conventional systems produce a little more than 13,000 plants. The increased population, naturally, requires an increase in fertilizer.

Wilkins also found that the spacing between plants on the two-row systems was more uniform than the conventional system. “The increased population and spacing uniformity for the

double-row system resulted in increased production from the first harvest, and an increase of 13 percent in total number of heads when considering all harvests, the engineer reports. This increase takes into account crop damage caused by the equipment. Wilkins cautions that the adaptation of such a system requires some modification to accommodate harvesting equipment.

The number of heads on the first harvest in the two-row field was 3,300 per acre while only 1,400 per acre were harvested in the conventional field.

Total heads for all harvests showed 12,500 in the two-row beds and 11,000 in the single row beds per acre. Heads were selectively harvested and ranged in size from 4½ to 6½ inches. The difference between the total plant population and the number of harvested heads mainly results from cauliflower heads being injured by harvesting equipment.

“If two rows are planted on every bed, then the wheels on the harvesting equipment will probably injure some of the unharvested plants. One possibility is to use a four-bed planter and plant three of the beds as double rows and one outside row as a single row. That will leave two single rows on every seventh and eighth bed which could be straddled by the harvesting equipment,” says Wilkins.

A grower could expect to gain from \$90 to \$200 per acre depending upon which zig-zag system he chose to plant, all rows planted zig-zag or every fourth bed planted as a single row.

Dr. Wilkins is stationed at the U.S. Agricultural Research Station, P.O. Box 5098, Salinas, CA 93915.—(By Paul Dean, SEA, Oakland, Calif.)

(Photo courtesy Grant Heilman)

Eye Clinic for Insects



Microelectrodes with a diameter tip of 10 microns are inserted into the compound eyes of the Caribbean fruit fly to test the insect's sensitivity to light (0579X875-29).

INSECTS reared in laboratories often have bad eyesight. Does this mean they take a dim view of the world? It does, and it concerns scientists who mass-rear them for important pest control programs.

A system for measuring visual sensitivity of insects called the "Vision Analyzer" is now used extensively as a research tool for monitoring mass-reared insect colonies.

Parasites, predators, and sterile males that are released for biological control of pest insects must be visually normal to fulfill their life cycle of dispersal, locating mates, and finding hosts. In other words, a laboratory-reared insect with poor vision can't compete with the wild insect it is expected to control.

Scientists believe that rearing procedures (such as larval density) and diets contribute to the inferior quality of reared insects. Early detection of any behavioral and physiological abnormalities is important.

Developed by SEA research entomologist Herndon R. Agee, the Vision Analyzer determines the normality of the visual system of the reared insect when it is compared with the wild insect. The electroretinogram or graphic record that is made by the Vision Analyzer is a measurement of the electrical voltages produced by the compound eye of the insect when the eye is exposed to flashes of light. The compound eye, typical of insects, consists of a great number of minute simple eyes closely crowded together.

The Vision Analyzer is connected to the photoreceptors of the eye—the part of the eye that receives light stimuli—by metal microelectrodes and measures the voltages that are produced.

"Brighter light flashes are needed to produce a standard voltage from an insensitive insect eye than from an eye that is more sensitive," says Agee. "Therefore, the insect with low visual

sensitivity would see the world dimly. The Vision Analyzer measures the sensitivity of the photoreceptors in the compound eye when the eye is exposed to flashes of light of known intensities. We can get very precise measurements with the Vision Analyzer system."

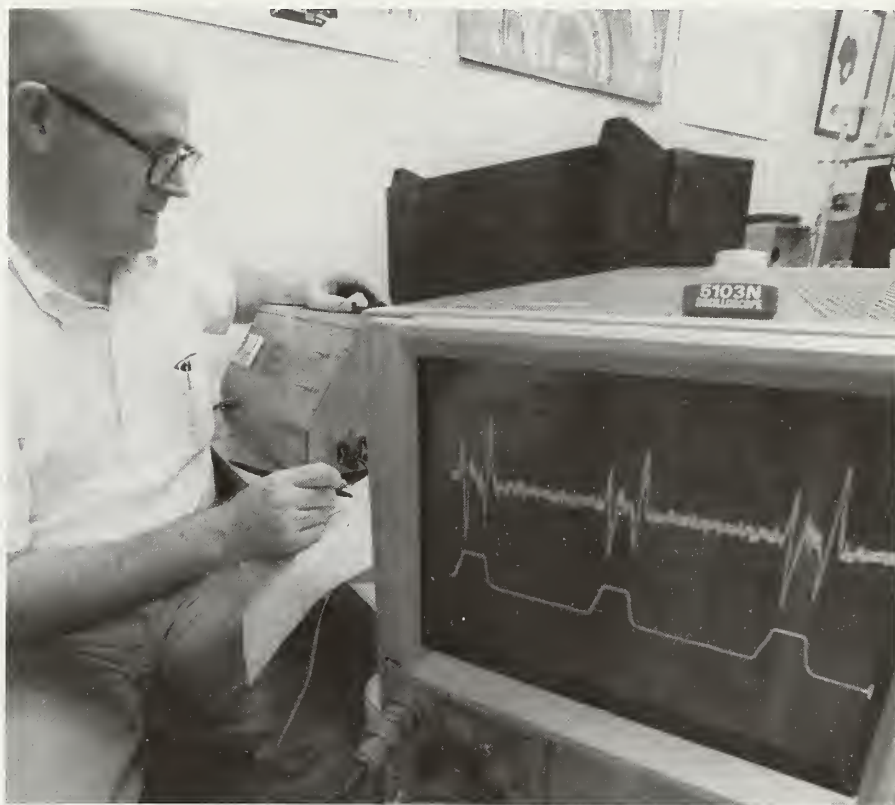
Agee's system is simple, inexpensive, and accurate. Importantly, the measurements can be made when the adult insects are young—1 to 3 days old. The Vision Analyzer can detect substandard insects early, avoiding the expense of releasing insects that would not perform their control functions in the field. Also, the Analyzer can be used as an early warning system, monitoring problems in brood colonies of the mass-rearing facility.

The Vision Analyzer is being used in Wädenswil, Switzerland, to measure the sensitivity of fruit flies from many Mediterranean Sea locations and Central America. Scientists from Australia have visited the USDA laboratory to learn the value of using the Vision Analyzer system to monitor production of mass-reared sheep flies.

Routine testing of the screwworm fly adults with the Vision Analyzer is part of the quality control program at the USDA Screwworm Research Laboratory in Mission, Texas, and testing is underway to apply the procedure to fruit fly production in Latin America, Europe, and Japan.

In July 1979, the Insect Vision Analyzer system was displayed at the U.S. Embassy in Peking, China, and will move to other cities in China throughout the coming year. It is one of 20 agriculture projects presented at the Embassy by the Exhibition Service, International Communication Agency.

Dr. Herndon R. Agee is with the SEA Insect Attractants, Behavior and Basic Biology Research Laboratory, 1700 Southwest 23d Drive, P.O. Box 14565, Gainesville, FL 32604.—(By Peggy Goodin, SEA, New Orleans, La.)



Agee uses the Insect Vision Analyzer to control the amount of light focusing on the insect's eye. The oscilloscope's top beam records the eye's electrical response to light; the bottom beam indicates light intensity (0579X876-12A).



Pinned and held down with tackiwax, this Caribbean fruit fly is about to have its eyes examined. If its vision is normal, the fly can be released into the field as part of the research project to control the species' population. (0579X877-26).

Pushing Plants to Full Potential

IT TOOK more than 3 years and 500 pounds of pollen for a team of scientists to identify the active ingredient of brassins, an extract from pollen of the rape plant known to produce rapid growth in a variety of plants. Finding the key compound was the first step in learning how it speeds growth, knowledge that could improve agriculture production.

The active compound is a steroid—the first plant steroid found to behave as a growth promoter. “It’s a unique chemical, highly biologically active,” said brassins research coordinator

George Steffens, referring to the fact that one one-billionth of a gram causes cells to elongate. Its proposed name is brassinolide.

Isolating and identifying brassinolide was a cooperative venture among scientists at several locations. Chemical engineer Michael Kozempel and colleagues at Philadelphia, assembled a multistep pilot plant to obtain an extract of brassins from the large amount of pollen. Then scientists at Beltsville, Md., and Peoria, Ill., led by chemists Nagabhushanam Mandava and Michael D. Grove, worked jointly to isolate and

analyze the active compound. Crystallographer Judith Flippen-Anderson at the Naval Research Laboratory in Washington, D.C., also contributed to the effort by using X-ray techniques to determine brassinolide’s structure.

“We had much difficulty in isolating and identifying the chemical responsible for the biological activity,” said Steffens who is chief of the Plant Hormone and Regulators Laboratory at Beltsville. It’s no wonder—when the laborious process was complete, the 500 pounds of pollen produced only about 15 milligrams of brassinolide. This amount of material is equivalent to a few grains of salt.

Now that the structure is known, chemist Malcolm Thompson of the Insect Physiology Laboratory at Beltsville, working with Mandava, has been able to synthesize several closely related compounds which have produced similar growth responses. The new synthetic compounds will allow researchers

A Nickel and Iron Dilemma?

TWO HUMAN health problems, nickel allergy and iron deficiency anemia, may be caught in a medical dilemma if findings from a study on laboratory rats some day prove relevant to human studies.

The study conducted by SEA biochemist Forrest C. Nielsen at the USDA Human Nutrition Research Laboratory, Grand Forks, N. Dak., showed that:

- Adding 50 micrograms of nickel to diets of rats that were extremely low in iron intensified iron deficiency symptoms—lethargy, slow body growth, rough hair coat, and pale eyes.

- Adding 50 micrograms of nickel to diets of rats that had about as much iron as needed resulted in improved growth and red blood cell production.

- Excluding practically all nickel from diets that had not quite enough iron resulted in impaired growth and red blood cell production.

Whether humans need minute amounts of dietary nickel is not known.

Nielsen says, “We need to gain further insights into the physiological role of nickel in animals before embarking on nickel studies in human nutrition.”

If the complexities of nickel and iron interactions apply to humans, a dilemma may have to be faced in dealing with nickel allergy and iron deficiency anemia. Both of these ailments afflict more women than men.

Some persons get hand eczema or dermatitis by touching nickel, but some researchers have suggested that dietary nickel may bring on allergic reactions.

to bypass the tedious extraction process and have ample material for large-scale testing on a variety of plant types.

Nine years ago when John Mitchell (now retired), Joseph Worley, and other scientists at Beltsville first discovered that brassins promoted plant growth, there were high expectations that this new "hormone" (then thought to be a combination of several compounds) would improve yields significantly (Agricultural Research, July 1970). And it has in many cases, but yields have been inconsistent.

The most consistent results have shown up in potato crops. By applying a brassins solution to the eyes of seed potatoes, plant physiologist Luis Gregory increased the number of potatoes harvested by as much as 24 percent. According to Werner Meudt, also a plant physiologist, brassins applied as a spray significantly increased yields of radishes and lettuce.

In greenhouse tests, the growth rate

of various plants was greatest when the extract was sprayed on very young, actively growing seedlings. This finding, coupled with other test results, lead Meudt to propose that brassinolide works in conjunction with other known hormones, such as auxin, to produce rapid growth. Gregory believes that the steroid may act as a hormone regulator, controlling the action of other hormones at the plant's actively growing sites.

How brassinolide interacts with hormones to accelerate normal growth rate is still a question looking for an answer. However, all involved in the project consider that a basic understanding of how brassinolide or its derivatives affect plant growth and development will certainly be of major benefit to agriculture in the future.

What is the potential of brassinolide for the farmer over the short term? Meudt sees it as a means of helping weak or undersized seedlings survive

under stress conditions—crowding, and lack of water or fertilizer. "If you have a substance which will take these little plants and baby them along so that they can compete with the bigger ones, you're indirectly increasing yield . . . We're not talking about breaking a yield barrier," adds Meudt. "We're trying to see that the plant reaches its potential. But, before it can be used effectively, we need to know how it works and when is the best time to apply it."

Michael Kozempel is located at the Eastern Regional Research Center, 600 East Mermaid Lane, Philadelphia, PA 19118, and Dr. Michael Grove is at the Northern Regional Research Center, 1815 North University, Peoria, IL 61604. Drs. George Steffens, N. Mandava, Luis Gregory, Werner Meudt, Joseph Worley, and Malcolm Thompson are located at the Beltsville Agricultural Research Center, Beltsville, MD 20705.—(By Judy McBride, SEA, Beltsville, Md.)

Should there be a curtailment of dietary nickel in food to protect nickel-sensitive individuals? Nielsen sees a drawback to this idea. Women who often consume barely adequate levels of iron might be adversely affected by low nickel diets.

In earlier studies, Nielsen found that nickel, arsenic, and vanadium play roles in nutrition of laboratory animals and that the effects of these nutrients on animals are related to other nutrients in their diets.

"As we gain knowledge about nutrient relationships and apply it to human nutrition research, we may find ways to help people avoid detrimental health effects caused by ill-advised attempts to supplement or restrict trace minerals in diets," he said.

In his latest studies, Nielsen found that various levels of dietary nickel and iron affected concentrations and distributions of other trace minerals and fatty substances such as cholesterol in the animals' bodies. This information will be useful to researchers as they compare findings of future studies.

"In past studies signs of nickel deprivation were not always similar possibly because of differences in the amount of iron in the animals," Nielsen said.

If nickel deprivation is a practical problem in humans, it may not apply to most people, Nielsen said. A nickel deprivation problem might affect persons with iron deficiency anemia, diseases that interfere with intestinal ab-

sorption, extreme physiological stresses, or unusual dietary habits.

Human requirements for nickel would be in the range of 16 to 25 micrograms per 1,000 calories consumed if extrapolation from animal tests could be proved valid, Nielsen said. Most human diets provide this amount.

A diet with an exceptionally low level of nickel would be one composed mostly of fats and foods of animal origin, Nielsen said. Sources of nickel in human diets include cereal grains and other seeds.

Dr. Forrest C. Nielsen is with the Human Nutrition Research Laboratory, 2420 Second Avenue North, Grand Forks, ND 58201.—(By Ben Hardin, SEA, Peoria, Ill.)



AGRISEARCH NOTES

To Store or Not To Store:

A RAPID, reliable test that estimates the percentage of growing potato plants infected with potato leafroll virus, could help the potato industry decide which lots of tubers to store and which to process immediately.

Potato leafroll virus is one of the most common of all the potato diseases. The chief problem it causes is that leafroll-infected tubers often develop net necrosis in storage. This results in extensive deterioration of the stored tubers. Until now, it's been generally impossible to determine how widespread a leafroll infection is in any given potato field.

But SEA plant pathologist Peter E. Thomas, Prosser, Wash., has developed a method for providing this information that is adaptable to massive testing.

The method involves extracting chlorophyll from potato plant leaves, then staining the leaves for starch with iodine in a timed sequence of steps. Development of black in all or part of a leaflet is a positive reading for leafroll virus infection.

The accuracy of Thomas' test for detecting leafroll virus has been 100 percent for Russet Burbank potatoes and just slightly less for the Kennebeck and Norgold varieties. In a field test for chronic leafroll, the test has proven to be 90 percent accurate.

Dr. Peter Thomas is located at the Irrigated Agriculture Research and Extension Center, P.O. Box 30, Prosser, WA 99350.—(By Lynn C. Yarris, SEA, Oakland, Calif.)

Instrumented Durable-Press Rating

WHEN ATTEMPTING to measure the electrostatic charge on cotton fibers, SEA physicist Louis C. Weiss identified the uneven surface of the fiber bundle as a possible source of error.

As he pondered the problem, it occurred to Weiss that the measurement "error" might be used to measure the degree of smoothness or roughness of durable-press fabrics and thus eliminate human rating panels. Score another success for serendipity, that welcome occasional companion of scientists.

Treated cotton, as most things do, has some electrostatic charge. One of the laws of physics states that the force between two charges varies inversely as the square of the distance. That is to say, the force between two objects is rapidly diminished as the objects move apart.

It is this change in force that Weiss has used to develop a rapid and objective method for measuring the performance of durable-press fabrics. Called an electrostatic profilometer, it is expected the method may see widespread use in industry as a quality control technique.

The equipment is composed of four major elements: a detector, a signal

amplifier, a recorder, and a sample carrier.

The detector or electrostatic probe is held stationary above a motor-driven carrier which moves the sample to be measured at any predetermined rate.

As the fabric passes beneath the detector, the voltage reaching the detector varies with the heights and depths of the hills and valleys of the wrinkles. As the differences in voltage reach the recorder, a profile is drawn showing the degree of smoothness or roughness of the fabric's surface that can be translated into durable press ratings.

Louis C. Weiss, is at the Southern Regional Research Center, P.O. Box 19687, New Orleans, LA 70179.—(By Vernon Bourdette, SEA, New Orleans, La.)

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

